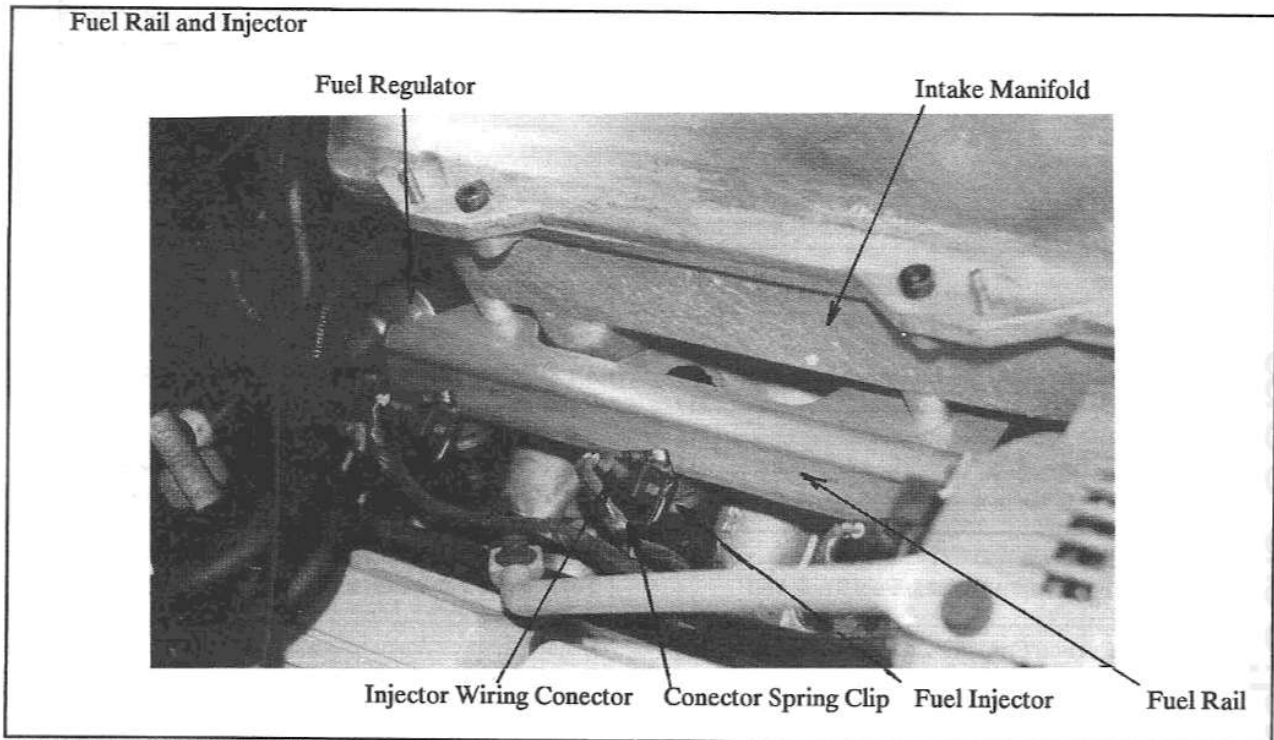


FUEL SYSTEM

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ELECTRONIC FUEL INJECTION.

ELECTRONIC FUEL INJECTION (EFI)



GENERAL DESCRIPTION

Fuel Injection Systems contain an electronic control module (ECM/PCM), manifold absolute pressure (MAP), throttle switch, fuel injectors, engine speed sensor, oxygen sensor, knock sensor and air & coolant temperature sensors.

Sensors are connected electrically to the ECM/PCM which interprets the data it receives and computes when and for how long the electrically operated injectors are held open. The basic fuel requirement of the engine is determined from the data supplied to the ECM/PCM by the MAP sensor. The other sensors increase or decrease the quantity of fuel injected.

A cold start system control, utilises a coolant temperature sensor. Extra air is supplied through a temperature controlled auxiliary air valve while the engine is warming. Idle rpm is controlled as engine temperature changes by the Idle Air Control (IAC) valve, located in the throttle body. The IAC valve alters the amount of air flow into the intake manifold, when the valve is open the rpm is higher and as the valve closes the rpm decreases.

Throttle stop screw is preset at the manufactures assembly line, it is protected by a plastic cap and should not be adjusted unless the diagnostic codes recommend the screw be adjusted.

Injectors are used to inject fuel into the intake port zone, these are operated by an electronic pulse which comes from the distributor or crank sensor via the ECM/PCM. It is the ECM which fine tunes the length of time that the injector stays open. Therefore allowing more or less fuel to enter the cylinder through the intake port zone. The injectors have an even amount unit of fuel pressure available to them from the fuel rail. (Not all fuel injection systems operate in this manner).

The fuel tank is located at the rear of the vehicle, on sedan models, the standard fuel tank is 63 litres capacity, with an 80-litre capacity long range fuel tank as optional equipment.

Utilities have a 68-litre capacity fuel tank.

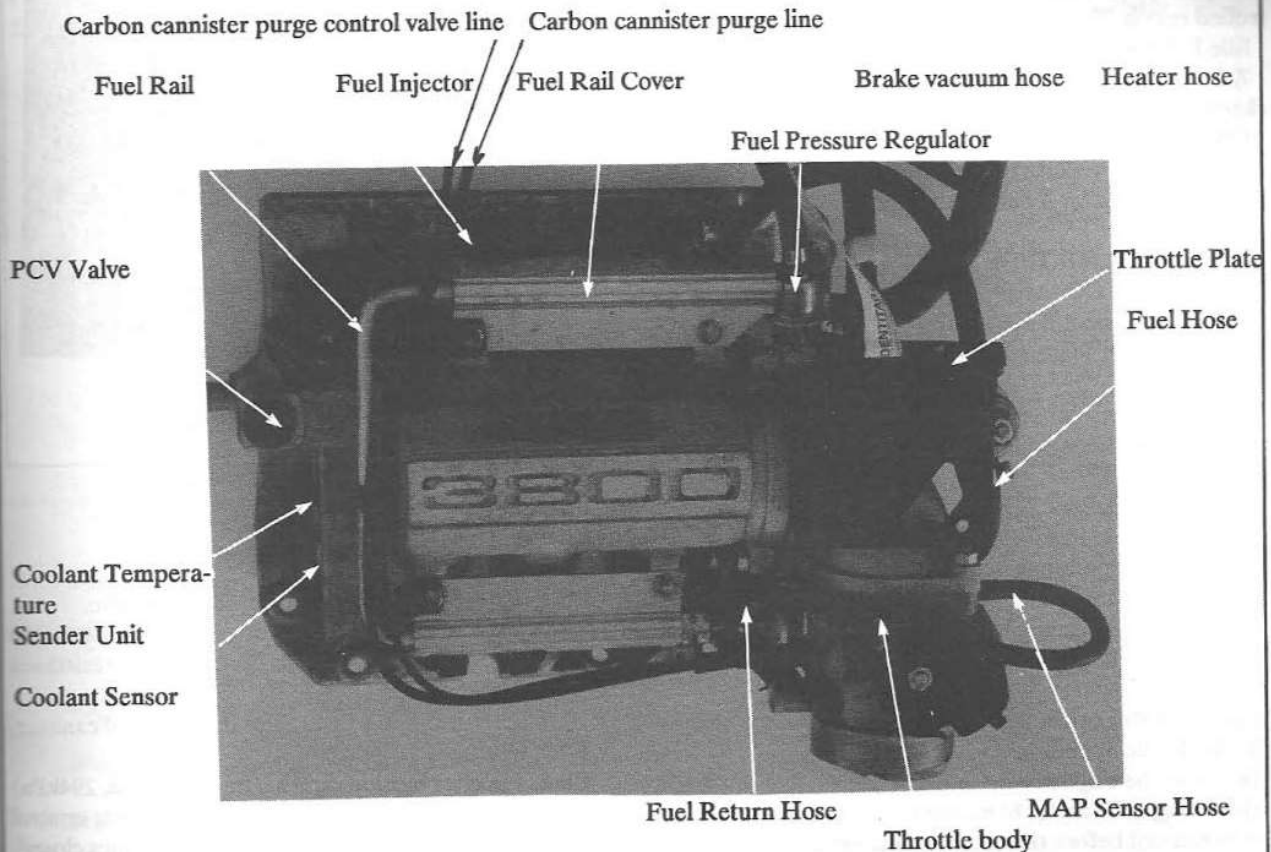
Station Wagons have a 68 litre capacity fuel tank.

The fuel tanks have an Evaporative Control System, which means that they are not vented to the atmosphere.

FUEL SYSTEM

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INTAKE MANIFOLD with Fuel Injection components



Instead they are vented to the fuel vapour carbon canister to be stored and dispersed through emission control system.

Vehicles with standard fuel tanks are fitted with a single in-tank high pressure fuel feed pump.

Vehicles fitted with V8 engines or a long range fuel tank have a lower pressure, high volume pump which acts as a priming pump within the fuel tank and an additional high pressure pump in the fuel feed line. The additional external pump is mounted in an insulated bracket attached to the floor pan.

ADJUSTMENTS

Throttle Stop Screw

The throttle stop screw should never be adjusted under normal conditions, only adjust if damaged due to an accident, changing over of throttle plate assembly or diagnostic code procedure.

The throttle stop screw sets the base idle rpm, while the IAC valve adjusts idle rpm due to engine and running variations.

Adjust

1. Engine at normal running temperature.
2. All sensors and vacuum hoses must be fitted properly.

3. Disconnect the IAC valve wiring loom connector, earth the test terminal on the ALDL.

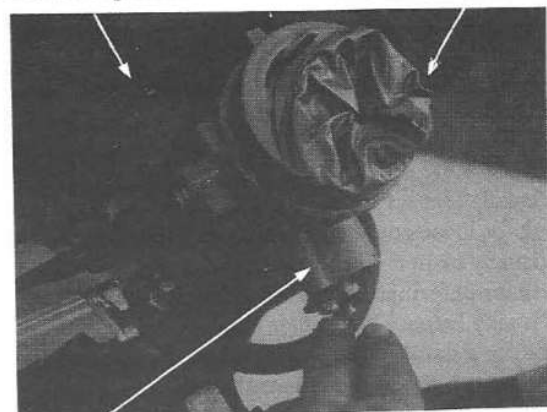
4. Connect a tachometer to engine if one is not fitted, use brown tachometer wire connector, located behind front left strut.

5. Remove plastic protection cap.

Throttle body

Throttle stop screw

IAC valve behind body



TPS sensor

6. Start engine and allow to idle, turn throttle stop screw to adjust rpm at less than IAC controlled rpm. IAC controlled rpm is 750 +/- 50 rpm.

Idle RPM specification (without IAC) 500-550 rpm

7. Stop engine, connect IAC wiring loom. Start engine check idle rpm for specification.

IAC controlled RPM 700-800 rpm

8. Stop engine replace throttle stop screw plastic cap and remove tachometer if one was temporarily fitted.

CHECK FUEL MIXTURE

Method with CO Meter

1. Visually Inspect E.F.I. system

(a) Check for loose screws or a loose mounting to the manifold.

(b) Check for wear in the linkage, missing snap rings or excessive looseness in the throttle shaft. Correct any problems found.

2. Initial Conditions:

(a) Air cleaner installed.

(b) Normal operating coolant temperature.

(c) All accessories switched off.

(d) All vacuum lines connected.

(e) Ignition timing set correctly.

(f) Transmission in the "N" range.

(g) CO meter operating normally.

3. Check Idle Speed.

(a) Start the engine.

(b) Using a CO meter to measure the CO concentration in the exhaust before the catalytic converter.

Idle speed:

V6 700-800

V8 700-800

4. Inspect CO Concentration.

(a) Check that the CO meter is properly calibrated.

(b) Race the engine 30-60 seconds at about 2,000 rpm before measuring concentration.

(c) Wait 1-3 minutes after racing the engine to allow the concentration to stabilize.

Idle CO concentration:

V6 0.5%-1.0%

V8 0.5%-1.0%

FUEL EVAPORATIVE EMISSION CONTROL SYSTEM.

INSPECTION OF FUEL VAPOR LINES, FUEL TANK AND TANK CAP.

1. Visually Inspect Lines And Connections.

Look for loose connection, kinks or damage.

2. Visually Inspect Fuel Tank.

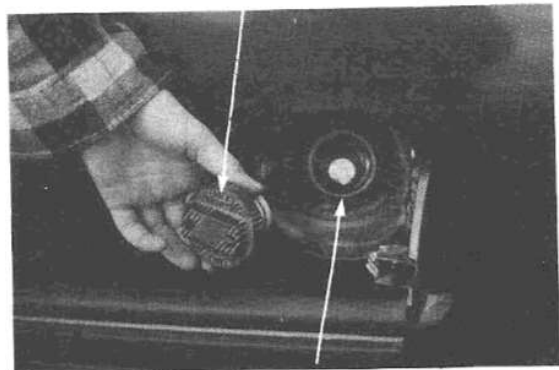
Look for deformation, cracks or fuel leakage.

3. Visually Inspect Fuel Filler Cap.

Look for a damaged or deformed gasket and cap.

If necessary, repair or replace the cap.

Visually Inspect Fuel Filler Cap



Note filler neck designed for unleaded fuel

INSPECTION OF CARBON CANISTER.

1. Remove Carbon Canister.

2. Visually Inspect Carbon Canister.

Look for cracks or damage.

3. Check for clogged filter and stuck check valve.

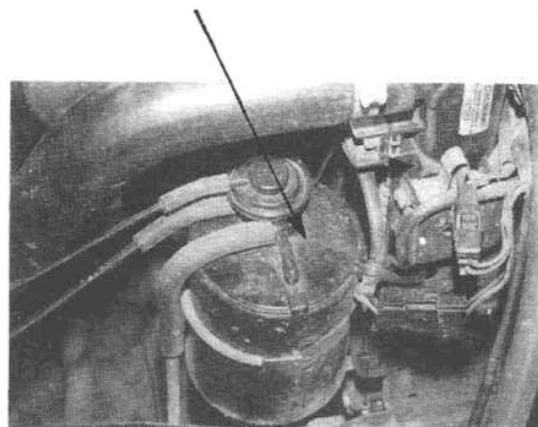
(a) Using low-pressure compressed air, blow into the tank pipe and check that the air flows without resistance from the other pipes

(b) If a problem is found, replace the charcoal canister.

4. Clean Filter In Canister

Clean the filter by blowing 3 kg/cm sq. (43 psi, 294kPa) of compressed air into the pipe to the outer vent control valve while holding the other upper canister pipes closed.

Carbon cannister



NOTE:

Do not attempt to wash the canister.

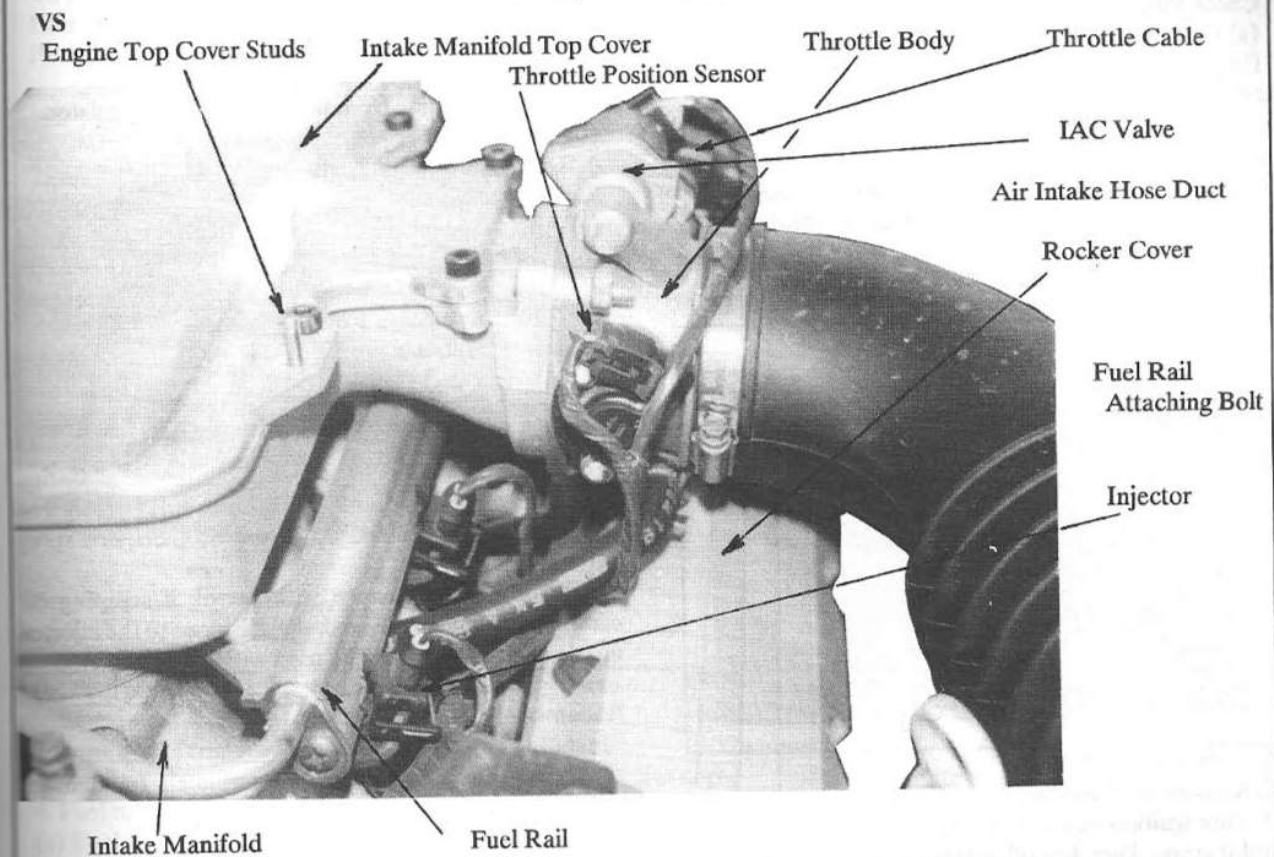
No activated carbon should come out.

5. Install Carbon Canister.

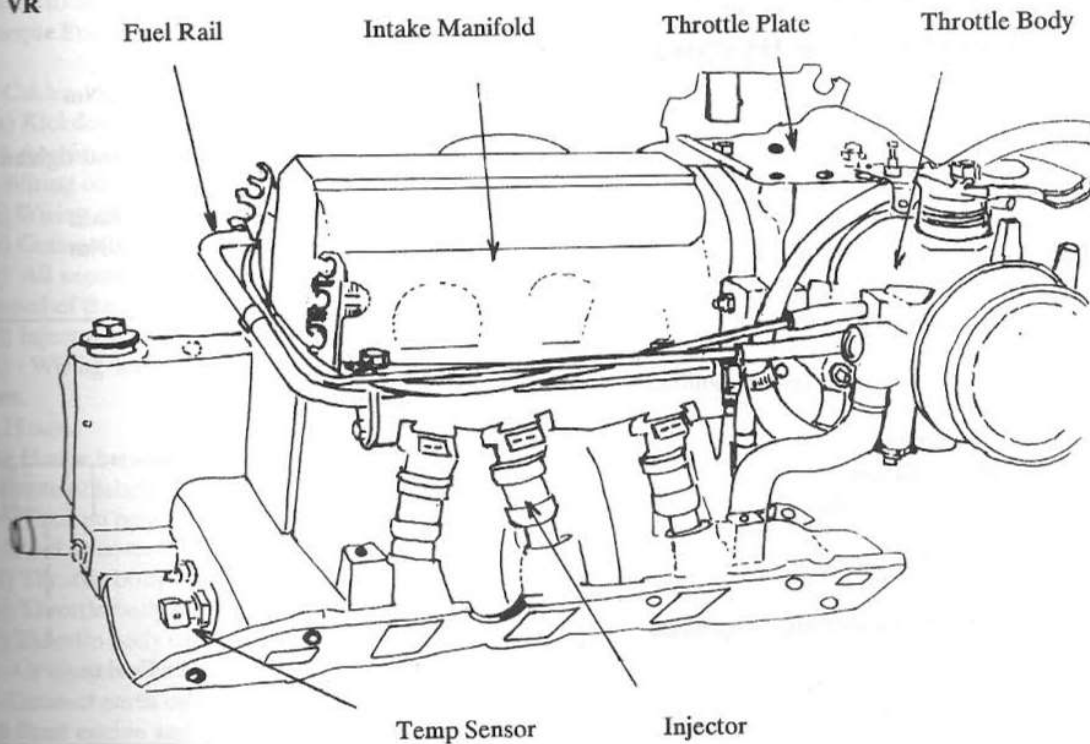
FUEL SYSTEM

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Fuel Injection System



VR



INSPECTION OF PURGE CONTROL VALVE

Check Purge Control Valve Operation.

- (a) Disconnect the hoses from the valve.
 - (b) Check that the valve is open when a vacuum is applied to the vacuum control connection.
 - (c) Check that the valve is closed when there is no vacuum present.
 - (d) Reconnect the hoses to the proper locations.
- If the valve does not operate, replace the valve.

DEPRESSURISE FUEL SYSTEM

Fuel pump fuse



1. Turn engine off.
2. Remove the Fuel Pump fuse, situated near the battery.
3. Turn ignition on and start engine, allow engine to idle until it stops. Turn key off and try to start engine again. This will depressurise the fuel system.

FUEL MIXTURE

The fuel mixture is adjusted at 14.7 : 1 and ideally maintained at that by the ECM and PCM

INJECTOR

Label all wiring connectors and hoses, so as to help in installation and assembly process.

Remove

1. Air cleaner ducting tube and battery earth cable.
2. Hoses to help in the removal of fuel rail and injectors.
 - (a) Hoses between carbon canister and throttle body, label to help replacing.
 - (b) Vacuum hoses from the rear of the intake manifold.
 - (c) Rocker cover breather hose.
 - (d) Throttle body vacuum hoses.
 - (e) Throttle body air intake ducting.
 - (f) Throttle body carbon cannister hoses.
3. Wiring connectors.
 - (a) Wiring connector to the throttle body.
 - (b) Connector to IAC valve.
 - (c) All sensor wiring connectors that may help in the removal of the fuel rail.
 - (d) Injector wiring loom and connectors.
 - (e) Wiring loom brackets bolts on the intake manifold.

4. Cables.

- (a) Kickdown cable (auto).
- (b) Accelerator cable

5. Fuel tubes.

- (a) Fuel return line from the fuel pressure regulator.
- (b) Fuel supply line to the fuel rail.

6. Remove fuel pressure regulator.**7. Fuel Rail**

- (a) Attaching bolts
- (b) Fuel rail

8. Injector

- (a) Clean all surfaces around injectors.
- (b) Injector retaining bracket.
- (c) Injector.

Test Injectors

Injectors should be tested on a commercial testing bench. Each injector should give an even spray of fuel that is atomised. There should not be any droplets, or a spray pattern to one side.

Injectors can be cleaned with petrol, if scraping off carbon build up, ensure no damage is done to the injector nozzle, a brass brush can be used with care.

Assembly**Install**

* Inspect all wiring plugs and terminals for damage before installation.

1. Cleaned or new injector.

- (a) Carefully position injector into place.
- (b) Clip in retaining bracket.

2. Fuel Rail.

- (a) Fuel rail into position.
- (b) Fuel rail attaching bolts to specification.

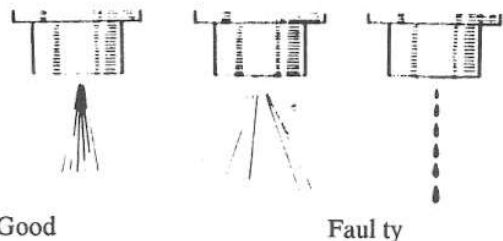
Torque Fuel Rail Attaching Bolts: 20-30Nm

3. Fuel pressure regulator.

- (a) Fuel pressure regulator to fuel rail and tighten to specification.

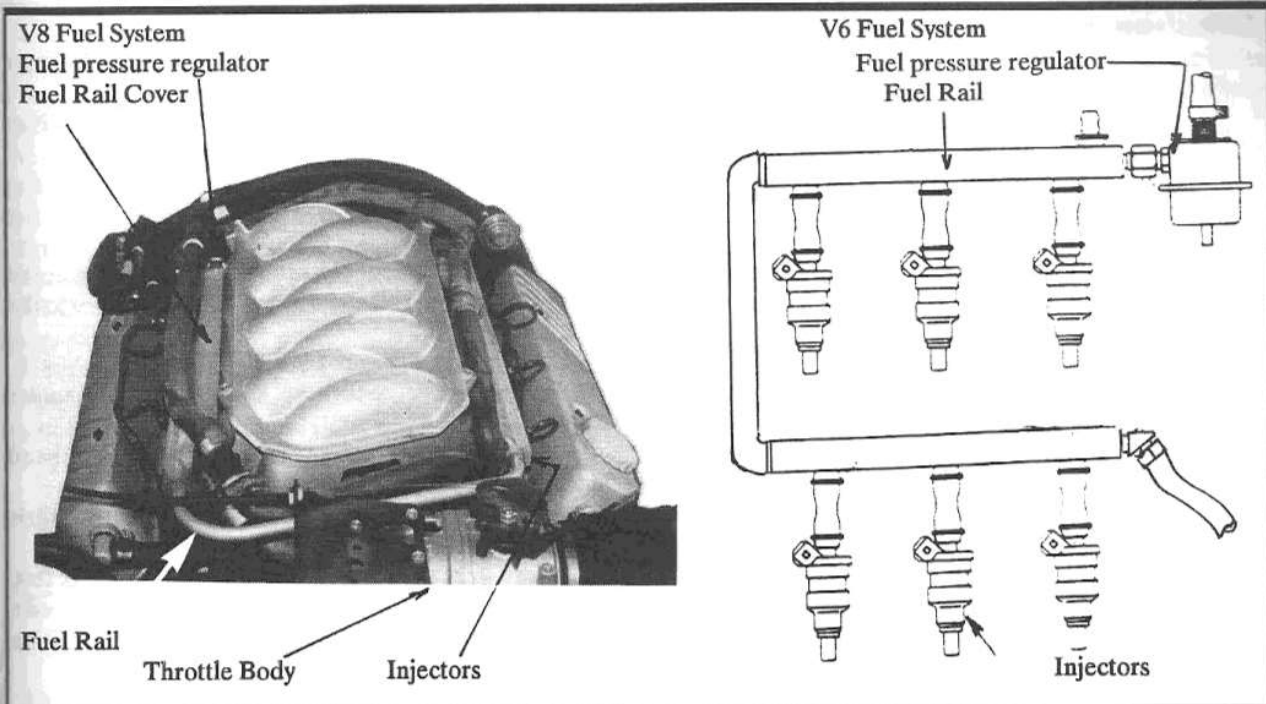
**Torque Fuel Pressure Regulator to Fuel Rail:
25-30Nm**

Injector Spray Test



FUEL SYSTEM

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(b) Fuel pressure regulator to bracket nut and tighten to specification.

Torque Fuel Pressure Regulator to Bracket Nut:
 20-25Nm

4. Fuel tubes.

(a) Fuel supply tube, tighten to specification.

Torque Fuel Supply Tube: 25-30Nm

(b) Fuel return line from fuel pressure regulator to specification.

Torque Fuel Return Line from Pressure Regulator:
 25-30Nm

5. Cables.

(a) Kickdown cable (auto).

(b) Accelerator cable

6. Wiring connectors.

(a) Wiring connector from the throttle body.

(b) Connector to IAC valve.

(c) All sensor wiring connectors that may help in the removal of the fuel rail.

(d) Injector wiring loom and connectors.

(e) Wiring loom brackets bolts on two of the intake tubes.

7. Hoses.

(a) Hoses between carbon canister and throttle body, take note of labels during removal.

(b) Vacuum hoses from the rear of the intake manifold.

(c) Rocker cover breather hose.

(d) Throttle body vacuum hoses.

(e) Throttle body air intake ducting.

(f) Throttle body carbon canister hoses.

8. Air cleaner ducting tube.

9. Connect earth cable to battery.

10. Start engine and check for leaks and idle RPM.

AIR FILTER

Remove

1. Disconnect air filter lower housing upper housing snap clips.

2. Remove air filter element.

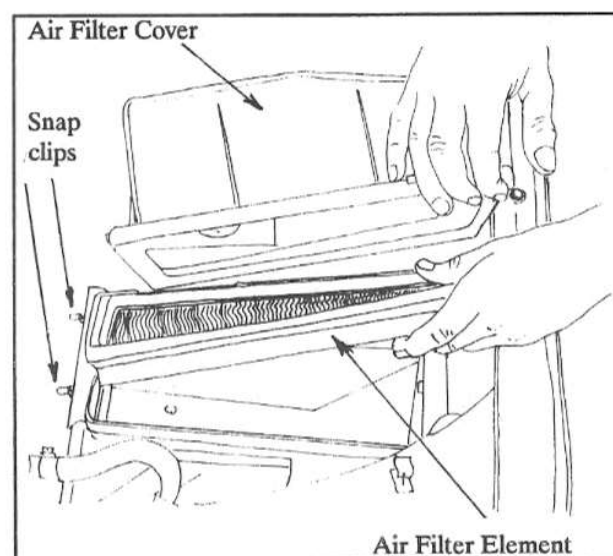
Install

1. Fit the new or cleaned air filter element into air filter housing.

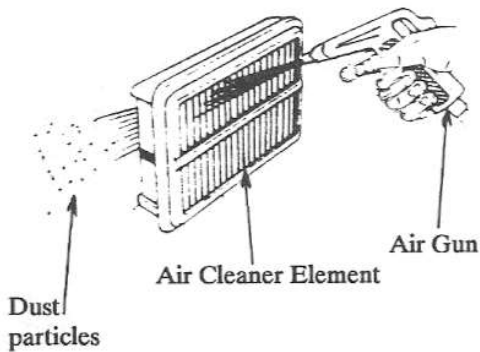
2. Replace the clips on the air filter housing.

INSPECT AIR FILTER

(a) Inspect the air cleaner element to ensure it is not excessively damaged, dirty or oily.



Clean element with air hose.

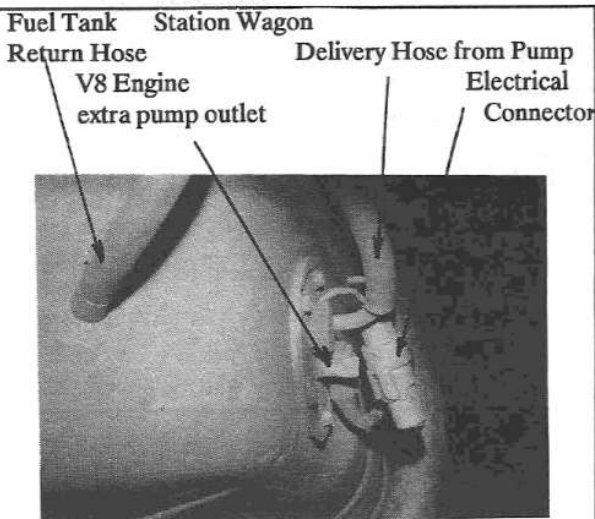


(b) Clean the filter element with compressed air. First clean the inside thoroughly, then clean the outside of the element.

FUEL TANK

Remove

1. Empty the fuel tank.
2. Remove filler neck stoneguard under the right hand fender.



3. Remove filler neck hose support bracket under fender.
4. Disconnect tank filler neck hoses at filler neck and check for kinks in hoses and replace if necessary.
5. Disconnect the fuel supply, return and vapour hoses, the filler neck hose and all electrical wiring connectors.
6. Support fuel tank with a jack or block of wood.
8. Remove the tank support strap bolts and nut to the body, and lower tank taking care as there could still be fuel in the tank.

Install

Check vapour and vent hoses for crimping or damage before and during installation.

1. Lift tank into position and install and torque strap attaching bolts and nut to specification.

Torque:

Bolts 26 - 32 Nm.

Nuts 15 - 25 Nm.

2. Connect the fuel supply, return and vapour hoses, the filler neck hose and all electrical wiring connectors to the tank.

3. Connect tank filler neck hoses at filler neck.

4. Replace filler neck hose support bracket under fender.

5. Replace filler neck stoneguard under the right hand fender.

6. Add at least 15 litres fuel to the tank if there is insufficient fuel in tank the fuel pump will not prime.

7. Before starting engine carry out fuel system leak test, by removing check for fuel leaks by using a jumper wire between the ALDL pink and violet wires with the ignition on. Check for leaks at pipe and hose joins.

FUEL GAUGE TANK UNIT AND PUMP ASSEMBLY

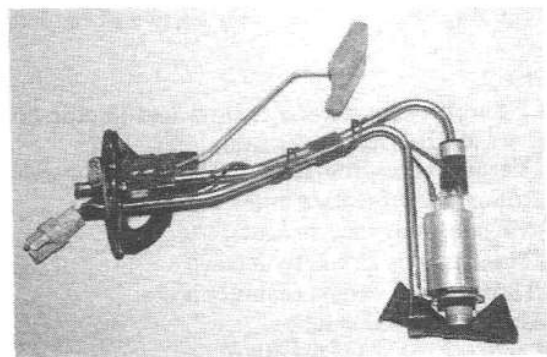
Remove

1. Remove fuel tank as previously described, gauge unit mounting bolts and sealing washers.
2. Remove fuel gauge sender unit and seal by lifting fuel pump filter from swirl pot.
3. Disconnect the electrical fittings.
4. Slide the pulsator up the riser pipe to clear the pump outlet, then remove pump from bracket.
3. Remove the fuel filter gauze with care, if it is damaged a new filter gauze will need to be fitted.

Install

1. Fit the pump to the bracket and slide the pulsator down to the pump.

High pressure pump inside fuel tank

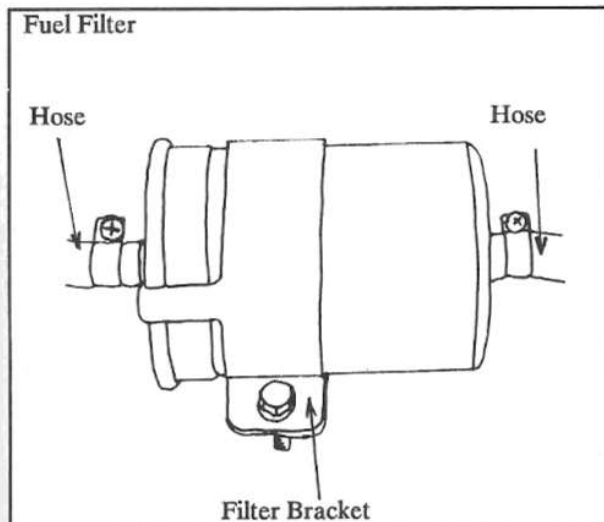


FUEL SYSTEM

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2. Connect the electrical fittings.
3. Replace the fuel filter gauze with care, if it is damaged a new filter gauze will need to be fitted.
3. Install a new seal to fuel gauge tank unit.
4. Carefully fit fuel gauge tank unit assembly into the tank, ensuring that sender unit is in the correct position and the pump filter locates in the swirl pot.
5. Fit new mounting bolts and torque to specification.
Sender Unit bolts torque specification: 2.0 - 3.5 Nm.
6. Fill fuel tank with fuel and check for fuel leaks around gauge unit.
7. Before starting engine carry out fuel system leak test, by removing check for fuel leaks by using a jumper wire between the ALDL pink and violet wires with the ignition on. Check for leaks at pipe and hose joins.

FUEL FILTER



Remove

1. Relieve fuel pressure as described earlier.
2. Place a container under the fuel line at the rear of the vehicle near the fuel tank, release the fuel hose clamps attached to the fuel filter.
3. Allow the excess fuel to drain into the container.
4. Remove filter clamp bolt and remove the filter.

Install

1. Check for the direction flow arrow on the side of the fuel filter, the arrow must point towards the front of the vehicle.
2. Slide the fuel clamps onto the fuel hoses allowing plenty of space for the filter inlet and outlet tubes to be inserted in to the hoses, slide the hoses onto the filter tubes and position the clamps in the correct position as shown.
3. Replace filter clamp and bolt and tighten to specification.

Filter clamp bolt specification: 20-25Nm

4. Before starting engine carry out fuel system leak test, by using a jumper wire between the ALDL pink and violet wires with the ignition on. Check for leaks at pipe and hose joins.

PROBLEM DIAGNOSIS

Problem: Cold engine is hard to start.

- Cause: *Cold start system faulty.
Action: *Test MAT (manifold air temperature) sensor.
Cause: *Fuel pump not operating
Action: *Check fuel pump fuse and pump relay.
Cause: *Engine coolant temperature sensor faulty.
Action: *Test sensor.
Cause: *Fuel pressure incorrect
Action: *Test fuel pressure.
Cause: *MAP (manifold air pressure) sensor not correct.
Action: *Test MAP sensor.
Cause: *Fuel injectors faulty or clogged.
Action: *Test fuel injectors.

Problem: Hot engine hard to start.

- Cause: *Insufficient fuel pressure.
Action: *Test fuel pressure.
Cause: *Fuel pressure incorrect.
Action: *Test fuel pressure.

Problem: Engine stalls or idles roughly (cold or warm).

- Cause: *Vacuum (intake air) leak.
Action: *Check for leaks.
Cause: *Idle system faulty.
Action: *Test IAC system.
Cause: *Engine coolant temperature sensor faulty.
Action: *Test sensor.
Cause: *MAP (manifold air pressure) sensor faulty.
Action: *Test MAP sensor.
Cause: *MAT Manifold air temperature sensor faulty.
Action: *Test MAT sensor.
Cause: *Fuel injectors faulty or clogged
Action: *Test fuel injectors.
Cause: *Insufficient fuel pressure or fuel delivery
Action: *Test fuel pressure and delivery.

Problem: Engine idles too fast

- Cause: *Vacuum (intake air) leak
Action: *Check for leaks.
Cause: *IAC system faulty
Action: *Test IAC valve or Diagnostic code for TPS (Throttle position) sensor.

Problem: Engine misses, hesitates, or stalls under load

- Cause: *Fuel injectors faulty or clogged

cardiagn.com

Action: *Test fuel injectors.
 Cause: *Vacuum (Intake air) leak
 Action: *Check for leaks
 Cause: *MAP (manifold air pressure) sensor faulty
 Action: *Test MAP sensor.
 Cause: * Sufficient fuel pressure or fuel delivery
 Action: *Test fuel pressure and delivery.

Problem: Low power

Cause: *Throttle not opening fully
 Action: *Check throttle cable.
 Cause: *Insufficient fuel delivery
 Action: *Test fuel delivery.
 Cause: *TPS (throttle position sensor) faulty.
 Action: *Test TPS sensor.
 Cause: *MAP (manifold air pressure) sensor faulty.
 Action: *Test MAP sensor.
 Cause: *Ignition system faulty.
 Action: *Check ignition timing and knock sensor control.

Problem: Fuel Delivery Pressure Low

Possible Cause:
 * Twisted or leaking fuel line.
 Remedy: *Check fuel lines for leaks as described in installation of fuel tank.
 * Check hose and pipe connections.
 Possible Cause:
 * Fuel pump gauze filter clogged.
 Remedy: * Remove fuel pump and check condition of fuel pump gauze.
 Possible Cause:
 * Fuel pump relief valve faulty.
 Remedy: * Replace fuel pump.
 Possible Cause:
 * Fuel pump faulty.
 Remedy: * Replace fuel pump.
 Possible Cause:
 * In line filter blocked.
 Remedy: * Replace in line filter near fuel tank.

Problem: Fuel Delivery Pressure High

Possible Cause:
 * Fuel pump relief valve faulty.
 Remedy: * Replace fuel pump.

Problem: No fuel at Fuel Rail

Possible Cause:
 * Kinked fuel line.
 Remedy: * Check fuel hoses and lines replace if necessary.
 Possible Cause:
 * In line fuel filter blocked.
 Remedy: * Replace in line filter near fuel tank.
 Possible Cause:

* Fuel pump relief valve faulty.
 Remedy: * Replace fuel pump.
 Possible Cause:
 * Fuel pump in operative.
 Remedy: * See below.

Problem: Fuel Pump Not Operating!

Possible Cause:
 * Fuel pump faulty.
 Remedy: * Test fuel pump.
 Possible Cause:
 * Wiring looms or connections faulty.
 Remedy: * Check wiring with test light or multimeter replace as required.
 Possible Cause:
 * Fuel pump control unit faulty.
 Remedy: * Replace control unit.

SPECIFICATIONS**Engine Idle RPM (In Neutral):**

Automatic Trans 650-750
 Manual Trans 650-750
 Idle CO Level: 0.5%-1.0%

Fuel Tank Capacity

Sedan	63 Litres
Station Wagon	68 Litres
Utility	68 Litres
V8 & optional	80 Litres
Statesman & Caprice	80 Litres

Electric Fuel Pump

Fuel Pump
 1.25 Litre/30sec(24g/sec) @ 240kPa

TORQUE WRENCH SPEC Nm

Fuel Pressure Regulator to Fuel Rail	25-30
Fuel Pressure Regulator to Bracket Nut	20-25
Fuel Rail to Lower Manifold	18-25
Fuel Inlet Tube to Fuel Rail	25-30
Fuel Return Tube to Fuel Pressure Regulator	25-30
Fuel Tank Strap Bolts	26 - 32
Fuel Tank Strap Nuts	15 - 25
Fuel Pipe Hose Clamps	0.5 - 3.0
Fuel Gauge Tank Unit Mounting Bolts	2.0 - 3.5
Utility Tank Mounting Bolts	36-65